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AUTHOR Gray, Peter J.
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ABSTRACT

This guide discusses four types of microcomputer-based communication programs that could prove useful to evaluators: (1) the direct communication of information generated by one computer to another computer; (2) using the microcomputer as a terminal to a mainframe computer to input, direct the analysis of, and/or output data using a statistical analysis program; (3) searching large databases maintained on a mainframe computer; and (4) using a microcomputer to send and receive personal messages. The key characteristics of telecommunications are discussed and 11 important telecommunications terms are defined. Additional topics addressed include: software typically used for telecommunications; the hardware required, i.e., a modem and interface; primary characteristics to look for in a modem; choosing the right telecommunication system; key characteristics of networking; considerations regarding multi-users systems; and basic system costs. It is noted that a multi-user system includes these five components: the hardware; the interface; the master controller (either a chip on the expansion card, a hard disc drive, or a dedicated computer); the system server; and the wiring to connect the system parts. Evaluators are cautioned that, while multi-user and networking systems are very appealing, at the present time they are not realistic because of copy protection procedures used by most software companies and the cost of multi-user versions of software. A list of references is provided. (JB)

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Guide Number 13

MICROCOMPUTERS: COMMUNICATION SOFTWARE

Peter J. Gray

The uses of microcomputer based communication programs are discussed, including:

- Telecommunication Uses
- Key Characteristics of Telecommunication
- Choosing the Right Telecommunication System
- Key Characteristics of Networking
- Considerations Regarding Multi-Us Systems

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Research on Evaluation Program Nick L. Smith, Director

Northwest Regional Educational Laboratory
300 S.W. Sixth Avenue • Portland, Oregon 97204 • Telephone (503) 248-6800

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TELECOMMUNICATION USES

There are four types of microcomputer communication that make it useful to evaluators. One is the direct communication of information generated by one computer to another computer. This involves, for example, tranferring between microcomputers text or other files from word processing, spreadsheet or statistical analysis programs.

Another communication application involves using a microcomputer as a terminal to a mainframe computer to input, direct the analysis of, and/or output data using a statistical analysis program on the mainframe computer (e.g., SPSS, SAS). In some cases the microcomputer is simply an input/output device like the "dumb" terminals traditionally connected to mainframe computers. In other cases the microcomputer is a "smart" computer which actually interacts with the mainframe computer. Telecommunications is the technology typically used for interaction between microcomputers and mainframe computers for remote data processing.

A third use of microcomputers for communication is to search large data bases maintained on a mainframe computer. One such data base familiar to educators is ERIC. There are many general and special data bases available from such companies as The Source, CompuServe, BRS After Dark, and Delphi (Howitt, 1984, November 5; Pearlman, 1984, July). These data bases include news and stock information, legal information, indexes of the contents of various publications, and travel information. There are also special data bases for particular areas. Because the mainframe computers that house these data bases are located in various parts of the country, telecommunication technology is used to access them by microcomputers.

The fourth communication application is using a microcomputer to send and receive personal messages. There are special electronic mail, computer conference, and electronic bulletin board systems that facilitate such communication. Electronic mail is one of the benefits usually claimed for the electronic office which is created through advanced networking technology. However, this and the other two personal message applications are also part of the services provided by the companies that are called information utilities (e.g., The Source, CompuServe). In addition, there are many focused message services run by local and national computer user's groups and special interest groups.

To make an informed choice among communication options, one has to know something about the technologies upon which they are based. There are essentially two technologies available for microcomputer communication. One is telecommunication technology which uses telephone lines to send and receive information over long distances (the focus of the first part of this guide). The other is multi-user or networking technology which physically links together two or more computers that are in relatively close proximity. The second part of this guide considers this technology.

KEY CHARACTERISTICS OF TELECOMMUNICATION

With telecommunication, the computer is connected to a modem (short for modulator/demodulator) which changes the electronic signal coming from the computer so that it may be sent over standard telephone lines. The modem at the other end of the line translates the signal back to its original form and relays it to a computer at that end.

Although the basic concepts of telecommunications are quite simple, some of the communications terms worth knowing are listed below.

Telecommunication Terms

ASCII: An acronym for American Standard Code for Information Interchange. This is the code used for most communications, since ASCII (pronounced asky) characters represent all of the numbers, letters, symbols and commands generated by a microcomputer.

Baud Rate: Measure of transmission speed in bits per second (bps).

Bit and Byte: Bit is a contraction of binary digit (a 1 or 0). A character (i.e., an ASCII letter, number, or symbol) is represented in the computer by seven data bits with a parity bit sometimes counted as part of the character. Together the seven or eight bits that make up a character are called a byte.

bps (bits per second): Measure of transmission speed. Each character transmitted requires 10 bits (1 start bit, 7 data bits, 1 parity bit, 1 stop bit). Therefore, 300 bps equals 30 characters per second.

Full Duplex: Here the transmission of data occurs in both directions. Each character or blocks of characters is echoed back to the originating computer acknowledging the accuracy of information while at the same time allowing new information to be sent. This also allows bidirectional file transfer.

Half Duplex: Here the transmission of data occurs in one direction at a time and information is not echoed back to the originating computer. Therefore, accuracy checking and file transfer is a start and stop process.

Modem: Contraction of modulator/demodulator. A device which translates the signals from a computer for transmission over telephone lines.

Parity Checking: A simple error detection procedure using the eighth bit of each character.

Protocol: A set of conventions controlling the transmission of data. The computers at each end must be using the same protocol or the transmission will fail.

RS-232: The standard connecting interface used in a computer to send and receive information in a bit-by-bit, or serial, fashion.

Terminal Program: The communication software used to control the process of telecommunication.

As suggested by the above definitions, there are some special demands placed on a microcomputer when it is used for telecommunications. In order for the microcomputer to perform this function, it must be equipped with special hardware directed by special software.

Software

The software typically used for telecommunications is called a terminal program, since such programs were first used to connect a simple terminal composed of a keyboard and display to a large computer. The main function of the program is to send ASCII characters out the cable through the interface to the modem and to interpret characters coming back from the modem.

Good telecommunication software gives the user extensive control over the communication process. One of the most important elements of this control is related to transmission options, such as setting the transmission rate (300 baud, 1200 baud) and error detection using parity checking in a full-duplex mode.

The software also controls the actual file transfer process. Exemplary software accepts the name of a file typed into the computer, gets the file, and sends it to the modem. The software controls the receipt of a file from the modem and gives the user the choice of having the file put into the active memory of the computer (random access memory, RAM) or storing it on a disk. The software also controls whether the files are transmitted character by character or in blocks.

Block-by-block transfer (i.e., sending), and capture (i.e., receipt), together with full-duplex echoing can dramatically increase the speed of communication. However, this requires the same communication program to be operating at both ends of the comunication link, since special protocols are used. For a more detailed discussion of the factors related to transmission speed, please refer to Gold (1984, July).

Another characteristic of good telecommunication software is the inclusion of "help features" built into the software and/or a tutorial on how to use the software. With help features, the program's operation is explained on the screen when information about a specific function is requested. A tutorial may be included as part of the software or simply as part of the user's manual. In either case, the purpose is to teach a person step by step how to use the various features of the program.

Advanced features of telecommunication software include unattended operation where the program can send and recieve information without the involvement of the operator at the time of operation. Related to this is the modem's ability to automatically answer and automatically dial telephone numbers. Another advanced feature is a program's ability to accept a series of commands in the form of one or a few macro-commands. In this way several key strokes can be saved, making the program easier and faster to use.

Hardware

The purpose of having sophisticated telecommunication software is to get the most from the hardware which performs the actual communication process. The required hardware is the modem, the device which sends signals out over the telephone line and translates the incoming messages, and the interface (e.g., RS-232) which transmits the signals from the computer to the modem and vice versa. The interface must therefore be compatible with the host computer and the modem of choice. Interface ports may be built into a computer or they may have to be added in the form of interface cards.

Modems may be either stand-alone units, or cards that can be inserted into the computer. The primary characteristics to look for in a modem are:

Speed: Most modems operate at 300 baud (30 characters per second), but this is quite slow, more desirable is a 1200 baud (120 characters per second, cps) modems.

Coupler Type: Most modems connect directly to the telephone line with a modular phone jack, some still use acoustic couplers, that is, rubber cups to hold the telephone headset.

Dialing Options: Most direct-connect modems can dial the telephone (auto-dial) when the number is typed at the keyboard or is selected from a directory, some can answer the telephone when it rings (auto-answer) or re-dial (auto-re-dial) the last number dialed if it was busy.

Dialing Directory: Some modems can store and display a directory of commonly called numbers.

Self Testing and Line Testing: Many modems have built-in testing programs designed to assess their own operation and the accuracy with which the characters are entering the telephone line. In addition, some programs can test the readiness of the telephone line to transmit information.

CHOOSING THE RIGHT TELECOMMUNICATION SYSTEM

To summarize, there are three components of a telecommunication system: the communication program, the modem, and the interface. Communication programs should be compared on the characteristics described in the previous discussion. These characteristics include the program's compatibility with particular machines, interfaces, operating systems and file types. Other characteristics are protocol options, baud rate(s), macro capabilities, and various convenience features such as on-line tutorials and unattended operation (Elia, 1984). Hemmes (1984, July) makes the case for 300 baud transmission, showing that faster is not always better. You need to decide for yourself about that and the other software features.

There are also some standard features of modems that should be considered. Modems should be compared in regard to their baud rates, dialing options, and communication modes (i.e., half-duplex or full duplex). In addition, it is important to determine whether they are stand-alone units, or are cards to be plugged into the computer, and which computers and operating

systems they are compatible with. Other considerations include whether they connect directly to the telephone or use an acoustic coupler, and whether they have such automatic features as self-testing and line testing (Powell, 1984).

While the most common interface is the RS-232, particular interface cards differ in the cables and connectors that must be used with them. If the modem itself is a card, then a separate interface is not required; but this type of modem will be limited to a particular machine (e.g., Apple, IBM).

Being able to telecommunicate is often not as simple as connecting the interface and modem and installing the software. The idiosyncrasies of microcomputers, of application programs, and of the communication hardware and software often require some experimentation. Therefore, as with other microcomputer uses, an important ingredient in the selection of a telecommunication system is the opportunity to try out the software and hardware before purchase and the extent of support offered by the supplier and/or manufacturer after purchase. Colleagues who use the microcomputer for communication tasks similar to those you anticipate are excellent sources of information and support. The references at the end of this guide provide additional information that can help you select the right telecommunication system.

KEY CHARACTERISTICS OF NETWORKING

There are alternatives to the telephone for transferring information between computers. Multi-users systems and local area networks (LANs) link computers that are close in proximity so that they can share information (i.e., data and programs) and peripherals (i.e., printers and hard disk drives).

Network Operation

Three recent developments have helped to make the use of microcomputer based multi-user and local area network systems more feasible. One is the change in the type of wiring which link together the components of a system. New multi-channel cables (coaxial broadband wiring like that used for cable television) have cut the cost of this important part of a network by two-thirds. They are replacing the older single-channel baseband cables which operate like twisted par telephone line. Coaxial broadband wiring also transmits information far more

quickly than baseband wiring and may eventually be used to carry data, voice, and video messages simultaneously. On the horizon is the use of fiberoptics cable. It is at present very expensive and therefore used for specialized applications.

Another recent development is the way the data are transferred. The earliest systems, such as those multi-user systems linked to mainframe computers, used a star pattern, where the master controller was located in the middle of "slave" terminals. The network distributed data from the center of the star along its arms to the terminal at each point. Communications were slow because everything had to be cleared and approved by the hard disk drive before it could proceed.

Most current LANs have either a circular configuration (i.e,. ring) or a linear configuration (i.e., bus). In these configurations, all of the hardware on the network issues instructions independently and the master controller simply directs the data traffic within the system.

The software which controls the system is also becoming more sophisticated. For example, the Unix language has been adopted by IBM for its most recent microcomputer, the IBM-PC AT, which boasts multi-user capabilities.

CONSIDERATIONS REGARDING MULTI-USERS SYSTEMS

While the multi-user system promises reduced cost through the ability to share software, data, and peripherals, the expense of putting together the network itself may offset any savings. The first expense is the hardware and software of the system. A basic system includes the five components listed below:

- the hardware, made up of computers and peripherals;
- the interface, typically an expansion card which plugs into the hardware;
- the master controller, either a chip on the expansion card, a hard disk drive, or a dedicated computer;
- the system server, a hard disk drive that carries both the software needed to operate the system and the programs available to network users;
- the wiring to connect the parts of the system.

(Rothfeder, 1983, June)

A basic system can cost between $4,000 and $50,000, depending on its sophistication and the number of terminals it includes.

In addition, the actual ability to share software and data may be restricted due to the copy protection procedures used by most software. And, the cost of multi-user versions of software may offset the potential savings.

In theory, multi-user and networking systems are very appealing. However, while they are important options, they are not realistic in most settings at present. As Gantz (1984, November 12) notes, "Someday, we'll install a local area network--the simplest and cheapest we can find without too much shopping." He goes on to say:

> We are stymied, though, by such mundane matters as how to run cables to desks in an open office plan. Do we drop them like pythons from the ceiling? What doesn't matter is whether we use baseband or broadband technology, whether the cable we snake is coaxial or twisted-pair, or whether our files move hither and yon in rings, stars, or loops. It matters not to us how many angels can sit on the head of a pin, only how much it costs per angle and what they'll do once they're there. (p. 42)

Multi-user and networking systems are based on one of the most rapidly changing microcomputer technologies. As a result, both their costs and capabilities are constantly changing. The potential buyer must be able to cut through the extravagant claims about potential advantages of these systems to determine whether the systems can really provide an advantage over simply exchanging diskettes among microcomputers.

It is hoped that this guide and such articles as "Straight Talk About Local Networks" (Green, 1984, September) can help to separate the potential advantages from the problems so that readers can make an informed choice about communicating with microcomputers.

REFERENCES

Butcher, D. E. (1984, Nov./Dec.). On line searching: How to get instant information. Electronic Learning, 39-40, 90.

Davis, D. B. (1984, March). Personal-computer networks go on-line. High Technology, 62-68.

Edelson, R. H. (1984, July). Buyers' guide to multi user computer systems. Interface Age, 51, 54, 56-59.

Elia, J. J. Jr. (1984, July). Communication software comparison chart. Popular Computing, 126.

Gantz, J. (1984, November 12). Replacement Market? Info World, 42.

Gold, J. (1984, July). How fast are you really communicating? Personal Computing, 149-150, 152, 156, 158, 195.

Green, J. O. (1984, September). Straight talk about local networks. Classroom Computer Learning, 72-75, 77.

Hemmes, J. (1984, July). The case for 300 baud. Popular Computing, 160-161.

Howitt, D. (1984, November 5). On-line services, the Source keeps trying: Does America need an information utility? InfoWorld, 59-64.

McGinty, T., (1984, Nov./Dec.). Buying modems: What to look for. Electronic Learning, 42-43, 92.

Pearlman, D. (1984, July). The joy of telecomputing. Popular Computing, 107-110, 152, 155-157

Powell, D. B. (1984a, July). T is for telecommunications. Popular Computing, 105-106.

Powell, D. B. (1984b, July) Buyer's guide for modems. Popular Computing, 111, 114-117, 158-161.

Powell, D. B. (1984c, July). Buyer's guide to communications software. Popular Computing, 121, 123-125.

Rothfeder, J. (1983, June). Networking the work place. Personal Computing, 7(6), 85.

Shea, G. (1984, Nov./Dec.). Information Services: The new frontier of communication. Electronic Learning, 33-34, 88-89.

Terrie, D. L. (n.d.) Local-area networks. Computerworld, 18(15), 35-38.

The, L. (1983, March) Data communications: A buyer's guide to modems and software. Personal Computing, 96-103; 108-111; 114-117; 122-124; 127-128; 171; 173.

White, R. & Lehrman, S. R. (1984, July). Three ways to say "hello." Popular Computing, 174-176, 179-182, 184.

Wohl, A. D. (n.d.) PC networks. Computerworld, 18(15), 45-48.

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Research on Evaluation Program
Northwest Regional Educational Laboratory
300 S. W. Sixth Avenue
Portland, OR 97204